

# PATENT ABSTRACTS OF JAPAN

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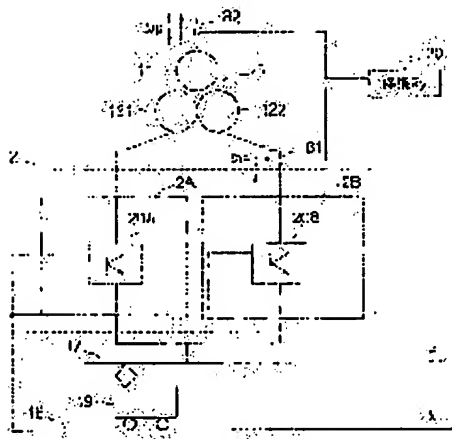
## (54) PROTECTIVE DEVICE FOR POWER CONVERTER

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a protective device for a power converter, to which an existing protection system is applicable as far as possible and which removes a section of protection at power running/regeneration and enables simplification of itself.

**SOLUTION:** This protective device for a power converter, which is equipped with two sets of power converters of the same constitution, capable of power running and regenerative running in parallel between a common AC power source and DC load, is equipped with a first current detecting means which detects the current of either of the two sets of power converters, a second current detecting means which detects the total current of the two sets of power converters, and a protective relay which compares both

current values detected by the first and second current detection means and decides that it is at least an internal of either of the two sets of power converters has faults within, when both current values deviate by a specified value or larger.



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[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the protective device of a power converter. Especially this invention relates to the suitable protective device for the power converter used in the direct-current substation for electric railways.

[0002]

[Description of the Prior Art]

Drawing 10 shows the protective device of the power converter by the conventional technique of a DC traction substation. Here, the diode rectifier (non-controllable rectifier) is shown as a power converter. In the DC traction substation of illustration, the alternating current power by which power receiving was carried out by transformer 1A for converters for power running is changed into direct current power by the diode rectifier 5, and the obtained direct current power is supplied to electric rolling stock 19 through the direct-current feeders 17 and 18 of a positive/negative (P, N) pair. The inverter 22 for regeneration is connected to the direct-current feeders 17 and 18 at juxtaposition at a rectifier 5, and the direct-current regeneration power from electric rolling stock 19 is changed into alternating current power, and is revived through transformer 1B for converters for regeneration here.

[0003]

The current protection at the time of power running makes possible the short circuit protection and the overcurrent protection to transformer 1A and a rectifier 5 by the current detecting element's 90 detecting the power running current  $I_{pw}$  which flows to the upstream of transformer 1A, and introducing it into protective relay (protection Ry) 20A. Similarly, at the time of regeneration operation, the hall device form current detector 91 in which the direct-current regeneration current  $I_{rg}$  of an inverter 22 was contained by the inverter 22 detects, and it is carrying out by introducing the detection output into protective relay 20B. Thus, the separate protective device was conventionally used at the time of power running and regeneration.

[0004]

[Problem(s) to be Solved by the Invention]

The protection at the time of the power running of the equipment of drawing 10 is aimed at the protection to the both sides of transformer 1A and a rectifier 5, and in the present inverter in the inclination which structure complicates, we do not result by pinpointing of a short circuit part, but are anxious about the time amount loss by primary diagnosis. Moreover, about the protective device for the regeneration protection which combines with the protection at the time of power running, and poses a problem, complication of a facility, an increment in reconstruction volume, etc. which included the control panel and the main distributing frame in complication of the system accompanying the increment in protection mark and the established facility which makes a hybrid converter method representation when the additional facility of the inverter was carried out become with a problem.

[0005]

Then, while this invention can apply the existing protection method as much as possible and losing the partition of the protection at the time of power running and regeneration, it aims at offering the protective device of the power converter which can simplify equipment.

[0006]

[Means for Solving the Problem]

Invention concerning claim 1 is the protective device of the power converter which equips juxtaposition with 2 sets of power converters of the same possible configuration of power running and regeneration operation between common AC power supply and a direct-current load. The 1st current detection means which detects one current of 2 sets of power converters, When both the current values detected by the 2nd current detection means which detects the total current of 2 sets of power converters, and the 1st and 2nd current detection means are compared and both current values shift beyond a predetermined value, It is characterized by having the protective relay judged to be one [ at least ] internal fault of 2 sets of power converters.

[0007]

Invention concerning claim 2 is set to the protective device of a power converter according to claim 1. It has the transformer for converters which has 2 sets of secondary windings between AC power supply and a power converter, and one side of 2 sets of secondary windings is connected to one side of 2 sets of power converters. Another side of 2 sets of secondary windings While outputting the electrical potential difference which has predetermined phase contrast to one secondary winding, it connects with another side of 2 sets of power converters. It is characterized by for 2 sets of power converters consisting of self-excitation formula translation machines, respectively, forming the 1st current detection means in one ac side of 2 sets of power converters, and forming the 2nd current detection means in the upstream of the transformer for converters.

[0008]

Invention concerning claim 3 is set to the protective device of a power converter according to claim 1. It has the transformer for converters which has 2 sets of secondary windings between AC power supply and a power converter, and one side of 2 sets of secondary windings is connected to one side of 2 sets of power converters. Another side of 2 sets of secondary windings While outputting the electrical potential difference which has predetermined phase contrast to one secondary winding, it connects with another side of 2 sets of power converters. The 1st current detection means is formed in one ac side of 2 sets of power converters, and the 2nd current detection means is formed in the upstream of the transformer for converters. 2 sets of power converters, respectively The diode rectifier for power running, It is characterized by consisting of self-excitation formula translation machines for regeneration operation by which parallel connection was carried out to this.

[0009]

Invention concerning claim 4 is set to the protective device of a power converter according to claim 1. It has the transformer for converters which has 2 sets of secondary windings between AC power supply and a power converter, and one side of 2 sets of secondary windings is connected to one side of 2 sets of power converters. Another side of 2 sets of secondary windings While outputting the electrical potential difference which has predetermined phase contrast to one secondary winding, it connects with another side of 2 sets of power converters. The 1st current detection means is formed in one 2 sets of direct-currents side of a power converter, and the 2nd current detection means is formed in the upstream of the transformer for converters. 2 sets of power converters, respectively The diode rectifier for power running, It is characterized by consisting of self-excitation formula translation machines for regeneration operation by which parallel connection was carried out to this.

[0010]

Invention concerning claim 5 is the protective device of the power converter which

equips juxtaposition with 2 sets of power converters of the same possible configuration of power running and regeneration operation between common AC power supply and a direct-current load. When the current value detected by 1st and 2nd current detection means to detect each current of 2 sets of power converters, and both [ these ] the currents detection means is compared and both current values shift beyond a predetermined value, It is characterized by having the protective relay judged to be one [ at least ] internal fault of 2 sets of power converters.

[0011]

In the protective device of a power converter according to claim 5, 2 sets of power converters consist of self-excitation formula translation machines for invention concerning claim 6, respectively, and it is characterized by forming the 1st and 2nd current detection means in the ac side of 2 sets of power converters, respectively.

[0012]

2 sets of power converters consist of self-excitation formula translation machines for regeneration operation with which parallel connection of the invention concerning claim 7 was carried out to the diode rectifier for power running in the protective device of a power converter according to claim 5 at this, respectively, and it is characterized by forming the 1st and 2nd current detection means in the ac side of 2 sets of power converters, respectively.

[0013]

2 sets of power converters consist of self-excitation formula translation machines for regeneration operation with which parallel connection of the invention concerning claim 8 was carried out to the diode rectifier for power running in the protective device of a power converter according to claim 5 at this, respectively, and it is characterized by forming the 1st and 2nd current detection means in the 2 sets of direct-currents side of a power converter, respectively.

[0014]

Invention concerning claim 9 is the protective device of the power converter equipped with the hybrid converter which carried out parallel connection of a diode rectifier and the self-excitation formula translation machine between common AC power supply and a direct-current load. The 1st current detection means which detects the alternating current of a hybrid converter, When the current value detected by the 2nd current detection means which detects the direct current of a hybrid converter, and the 1st and 2nd current detection means is compared and both current values shift beyond a predetermined value, It is characterized by having the protective relay judged to be one [ at least ] internal fault of a diode rectifier and a self-excitation formula translation machine.

[0015]

Invention concerning claim 10 is the protective device of the power converter equipped with the hybrid converter which carried out parallel connection of a diode rectifier and the self-excitation formula translation machine between common AC power supply and a direct-current load. The 1st current detection means which detects the direct current of a diode rectifier, and the 2nd current detection means which detects the direct current of a hybrid converter, The direct current of the diode rectifier detected by the 1st current detection means becomes beyond a predetermined value. And it is characterized by having the protective relay which judges it by detecting that the direct current of the hybrid converter detected by the 2nd current detection means is negative to be the internal fault of a hybrid converter.

[0016]

Invention concerning claim 11 is the protective device of the power converter

equipped with the hybrid converter which carried out parallel connection of a diode rectifier and the self-excitation formula translation machine between common AC power supply and a direct-current load. The 1st current detection means which detects the direct current of a diode rectifier, and the 2nd current detection means which detects the direct current of a self-excitation formula translation machine, The direct current of the diode rectifier detected by the 1st current detection means becomes beyond a predetermined value. And it is characterized by having the protective relay which judges it by detecting that the direct current of the self-excitation formula translation machine detected by the 2nd current detection means is negative to be the internal fault of a hybrid converter.

[0017]

[Embodiment of the Invention]

<The gestalt 1 of operation>

Hereafter, it explains, referring to drawing 1 about the gestalt 1 of operation. With the gestalt 1 of operation, the three-phase-circuit 3 coil transformer 1 which has a primary winding 11 and 2 sets of secondary windings 12 and 13 is formed as a transformer for converters. 2 sets of secondary windings 12 and 13 output mutually the alternating voltage of the same value which has 30-degree phase contrast by making one side into delta connection (delta connection), and making another side into star connection (Y connection). Three-phase-circuit self-excitation type power converter 2A of bridge connection and 2B rectify the output voltage of secondary windings 12 and 13, respectively, by being a direct-current side and compounding the output rectification electrical potential difference (respectively 6 pulse rectification electrical potential difference), the direct current voltage of 12 pulse rectification is obtained as a result, and electric rolling stock 19 is supplied through the direct-current feeders 17 and 18. 2 sets of three-phase-circuit self-excitation type power converter 2A and 2Bs are the same configuration and the amount of isochore, and the self-excitation type power converter 2 of 12 pulse rectifier type is constituted by both.

[0018]

In the self-excitation type power converter 2, since a current equivalent to one half of all the currents of an inverter 2 flows to each power converter 2A and 2B, only one of power converters forms the current detecting element 82 which detects the primary current  $I_{ap}$  in the upstream of the transformer 1 for converters, while forming the current detecting element 81 which detects the input current  $I_{as}$  of power converter 2B. Since it is easy, it is 1, then always a turn ratio between the primary winding 11 of a transformer 1 and a secondary winding 12, and 13,

$I_{ap}=2, I_{as} \text{ -- (1)}$

It becomes. If the turn ratio of a primary-winding pair secondary winding is generally set to  $n$ ,

$n \cdot I_{ap}=2, I_{as} \text{ -- (2)}$

It becomes.

[0019]

Then, when both the currents  $I_{ap}$  and  $I_{as}$  are detected, a difference ( $=n \cdot I_{ap} - 2, I_{as}$ ) with  $n \cdot I_{ap}, 2$ , and  $I_{as}$  is supervised with a protective relay 20 and both difference shifts from 0 beyond a predetermined value, a protective relay 20 operates, for example, current protection of intercepting the upstream of a transformer 1 or intercepting the direct-current output side of an inverter is performed.

[0020]

With the gestalt 1 of operation, since the current of about 1/2 capacity of full capacity flows to one side of both the converters that constitute 12 phase self-excitation

formula translation equipment, the current detecting element 8 is formed only in either, the current value 2 of 2 twice of the detection current and  $I_{as}$  are compared with current value  $n \cdot I_{ap}$  equivalent to the turn ratio twice of a transformer upstream current, and detection protection of inverter internal fault is attained by supervising the difference of both current values. It combines with the existence of the internal fault of an inverter 2 in this way, and the power running and regeneration protection by the same relay are attained.

[0021]

<The gestalt 2 of operation>

Drawing 2 shows the gestalt 2 of operation. The power converter 3 containing 2 sets of hybrid converters 3A and 3B which come to stand in a row the diode rectifiers 30A and 30B for the power converter of the main circuit in the gestalt 2 of this operation to supply a power running current at the self-excitation type power converters 20A and 20B, respectively is formed.

[0022]

The power converter 3 of drawing 2 is functionally equivalent to the power converter 2 of drawing 1, therefore can carry out the configuration for current detection and current protection according to the case of drawing 1. Therefore, while forming the current detecting element 81 which detects the input current  $I_{as}$  of one power converter 3A here, the current detecting element 82 which detects the primary current  $I_{ap}$  is formed in the upstream of the transformer 1 for converters, and both the detection current is introduced into a protective relay 20.

[0023]

Also in the equipment of drawing 2, like the equipment of drawing 1, when the conditions of (2) types collapse beyond a predetermined value, a protective relay 20 operates and current protection is performed.

[0024]

Also in the gestalt of this operation, inverter internal fault protection is possible. It combines with the existence of inverter internal fault, and the power running and regeneration protection by the same relay are possible.

[0025]

<The gestalt 3 of operation>

Hereafter, it explains, referring to a drawing about the gestalt 3 of operation. The main circuit in the gestalt of this operation is the same as that of the thing of drawing 2 and drawing 5. Here, for current protection, the current detecting element 82 which detects the upstream current  $I_{ap}$  of a transformer 1, and the current detecting element 86 which detects the direct-current side current  $I_{da}$  of one power converter 3A are formed, and both the detection currents  $I_{ap}$  and  $I_{da}$  are introduced into a protective relay 20.

[0026]

In this case, the current of 2 sets of power converters 3A and 3B sees on an equal, then actual-value level mostly, and sets the turn ratio of a transformer 1 to  $n$  like the case of drawing 1,  
 $n \cdot I_{ap} = 2, I_{da} \rightarrow (3)$

It becomes.

[0027]

Therefore, when both the currents  $I_{ap}$  and  $I_{da}$  are detected, a difference with  $n \cdot I_{ap}$ , 2, and  $I_{da}$  is supervised with a protective relay 20 and both difference shifts from zero beyond a predetermined value, a protective relay 20 operates and current protection is performed.

[0028]

With the gestalt of this operation, when the current detecting elements 9 and 13 are formed in the direct-current side of one [ the transformer upstream and ] power converter 3A and that balance collapses on the basis of the balance condition of (3) types beyond a predetermined value, it can be detected with a protective relay 20 and inverter internal fault can be protected. Furthermore it combines with the existence of inverter internal fault, and the power running and regeneration protection by the same relay are also possible.

[0029]

<The gestalt 4 of operation>

Drawing 4 shows the gestalt 4 of operation. The main circuit of drawing 4 is the same as that of it of drawing 1 . With the gestalt of this operation, both converter 2A and the current detecting elements 83 and 84 which detect an alternating current input current for every 2B are formed, and those detection currents  $I_{aa}$  and  $I_{ab}$  are introduced into a protective relay 20. The alternating current  $I_{aa}$  and  $I_{ab}$  which flows into each group translating equipment is always,

$I_{aa}=I_{ab}$  -- (4)

It comes out.

[0030]

However, when the difference beyond a predetermined value arises and the conditions of the conditions of (4) types,  $I_{aa}/I_{ab}=1$  [ i.e., ], and  $I_{aa}-I_{ab}=0$  collapse between both the currents  $I_{aa}$  and  $I_{ab}$ , a protective relay 20 operates.

[0031]

With the gestalt of this operation, since the current of the same value flows to each converter 2A of six phases, and 2B when 12 phase self-excitation formula translation equipment is applied, detection protection of inverter internal fault is attained by preparing a current detecting element in the ac side of each converter, and supervising the ratio or difference of alternating current  $I_{aa}$  and  $I_{ab}$  which flows into each converter. It combines with the existence of inverter internal fault, and the power running and regeneration protection by the same relay are possible.

[0032]

<The gestalt 5 of operation>

Drawing 5 shows the gestalt 5 of operation. The main circuit in the gestalt 5 of this operation is the same as that of it of drawing 2 . With the gestalt of this operation, the current detecting elements 10 and 11 which detect an alternating current input current are formed in every both power converter 3A and 3B, and those detection currents  $I_{aa}$  and  $I_{ab}$  are introduced into a protective relay 20.

[0033]

The power converter 3 of drawing 5 is functionally equivalent to the power converter 2 of drawing 4 , therefore can carry out the configuration for current detection and current protection according to the case of drawing 4 . Therefore, the current detecting elements 83 and 84 which detect the input currents  $I_{aa}$  and  $I_{ab}$  of both the power converters 3A and 3B are formed here, and both the detection current is introduced into a protective relay 20.

[0034]

Also in the equipment of drawing 5 , like the equipment of drawing 4 , when the conditions of (4) types shift beyond a predetermined value, a protective relay 20 operates and current protection is performed.

[0035]

Thus, also in the gestalt of this operation, protection of the power running and

regeneration by the same relay is attained with inverter internal fault protection.

[0036]

<The gestalt 6 of operation>

The gestalt 6 of operation is explained with reference to drawing 6 . The main circuit of the gestalt 6 of this operation is the same as that of drawing 2 and it of 4 and 6.

Here, the current detecting elements 86 and 87 which detect each direct current  $I_{da}$  and  $I_{db}$  are formed in the direct-current side of both the converters 3A and 3B, and both the detection currents  $I_{da}$  and  $I_{db}$  are introduced into a protective relay 20.

[0037]

In this case, the direct-current output current of 2 sets of converters 3A and 3B is equal, and, in the case of drawing 5 , it always (always [ forward ]) applies correspondingly,

$I_{da}=I_{db}$  -- (5)

It comes out.

[0038]

Therefore, when both the currents  $I_{da}$  and  $I_{db}$  are detected, both difference is supervised with a protective relay 20 and both difference shifts from 0 (zero) beyond a predetermined value, a protective relay 20 operates and current protection is performed.

[0039]

In the case of drawing 3 , the following operation and effectiveness apply correspondingly.

[0040]

<The gestalt 7 of operation>

Drawing 7 shows the gestalt 7 of operation. The transformer 1 for converters of the main circuit in the gestalt of this operation is two-volume linearity, and 1 set of hybrid converters 4 by which diode rectifier 4A and self-excitation type power converter 4B of order reverse concomitant use were connected to juxtaposition secondary [ that ] are formed. Rectifier 4A and converter 4B pay a power running current together, and converter 4B pays a regeneration current.

[0041]

For current protection, the current detecting element 81 which detects the ac side current  $I_{as}$  of the hybrid converter 4, and the current detecting element 85 which detects the direct-current side current  $I_{dc}$  are formed, and both the detection current is introduced into a protective relay 20.

[0042]

When the converter 4 is always outputting the power running current, rectifier 4A and converter 4B make  $k$  a proportionality constant,

$I_{as}=k \cdot I_{dc}$  -- (6)

A current flows with unrelated relation.

[0043]

Therefore, a protective relay 20 supervises the difference of the left part of (6) types, and the right-hand side, and when it opens beyond a predetermined value, a protective relay 20 takes out an output of operation.

[0044]

Also in the gestalt of this operation, inverter internal fault protection is possible, it combines with the existence of inverter internal fault, and the power running and regeneration protection by the same relay are possible.

[0045]

<The gestalt 8 of operation>



The gestalt 8 of operation is explained with reference to drawing 8 . The main circuit of the gestalt of this operation is the same as that of it of drawing 7 , and is equipped with the hybrid converter 4 which consists of diode rectifier 4A and self-excitation formula translation machine 4B.

[0046]

Here, for current protection, the current detecting element 88 which detects the direct current  $I_{dd}$  which flows rectifier 4A, and the current detecting element 85 which detects the direct-current side current  $I_{dc}$  of a converter 4 are formed, and both the detection current is introduced into a protective relay 20.

[0047]

With the gestalt of this operation, when more than constant value with the rectifier current  $I_{dd}$  and a hybrid converter direct current  $I_{dc}$  become a negative value, a protective relay 20 operates. "The case where more than constant value with the rectifier current  $I_{dd}$  and a hybrid converter direct current  $I_{dc}$  become a negative value" here In a power-running condition, the situation which produced the ground fault at the direct-current side node of diode rectifier 4A and self-excitation formula translation machine 4B is coped with. Therefore, the rectifier current  $I_{dd}$  of a ground current flows to diode rectifier 4A, and a current flows backwards from the direct-current feeder 17 side to a converter 4 side to the current detecting element 85. This can be detected with a protective relay 20 and inverter protection can be aimed at.

[0048]

Thus, according to this operation gestalt, it combines with the existence of inverter internal fault, and the protection at the time of power running is attained.

[0049]

<The gestalt 9 of operation>

Drawing 9 shows the gestalt 9 of operation. The main circuit in the gestalt of this operation is equipped with the hybrid converter 4 which consists of diode rectifier 4A and self-excitation formula translation machine 4B of drawing 7 and 8.

[0050]

Here, for current protection, the current detecting element 88 which detects the direct current  $I_{dd}$  which flows rectifier 4A, and the current detecting element 89 which detects the direct current  $I_{dx}$  of self-excitation formula translation machine 4B are formed, and both the detection current is introduced into a protective relay 20. when a rectifier direct current  $I_{dd}$  exceeds setting, and comes out and the direct current  $I_{dx}$  of converter 4B becomes a negative value, a protective relay 20 makes it operate with the gestalt of this operation

[0051]

With the gestalt of this operation, when the direct current  $I_{dx}$  of more than constant value with the rectifier current  $I_{dd}$  and converter 4B becomes a negative value, a protective relay 20 is operated. Here, "the case where more than constant value with the rectifier current  $I_{dd}$  and the self-excitation formula translation machine current  $I_{dx}$  become a negative value" copes with the situation which produced component failure in self-excitation formula translation machine 4B in a power-running condition. Although the rate of  $I_{dd}/I_{dx}=98/2$  shares the power running current at the time of normal power running, when component failure is produced in self-excitation formula translation machine 4B, without flowing to the direct-current feeder 17 side, the rectifier current  $I_{dd}$  flows backwards the current detecting element 89, and flows to the self-excitation formula translation machine 4B side. At this time, it becomes the current value exceeding above 98 (%) as a rectifier current  $I_{dd}$ . Therefore, this can be detected with a protective relay 20 and inverter protection can be aimed at.

[0052]

Converter internal fault can be detected as mentioned above, and the protection can be aimed at. Moreover, it combines with the existence of inverter internal fault, and the protection at the time of power running is attained.

[0053]

[Effect of the Invention]

According to this invention, two currents of the arbitration of the power converter which consists of a unit converter of two groups of parallel connection are detected, inverter internal fault can be detected and combined by the comparison of the detection current, and the power running and regeneration protection by the same relay can be attained.

[Brief Description of the Drawings]

[Drawing 1] Schematics for explaining the gestalt 1 of operation of this invention which applied this invention to protection of 12 pulse self-excitation type power converter.

[Drawing 2] Schematics for explaining the gestalt 2 of operation of this invention which applied this invention to protection of 12 pulse hybrid converter.

[Drawing 3] Schematics for explaining the gestalt 3 of operation of this invention which applied this invention to protection of 12 pulse hybrid converter.

[Drawing 4] Schematics for explaining the gestalt 4 of operation of this invention which applied this invention to protection of 12 pulse self-excitation type power converter.

[Drawing 5] Schematics for explaining the gestalt 5 of operation of this invention which applied this invention to protection of 12 pulse hybrid converter.

[Drawing 6] Schematics for explaining the gestalt 6 of operation of this invention which applied this invention to protection of 12 pulse hybrid converter.

[Drawing 7] Schematics for explaining the gestalt 7 of operation of this invention which applied this invention to protection of a hybrid converter.

[Drawing 8] Schematics for explaining the gestalt 8 of operation of this invention which applied this invention to protection of a hybrid converter.

[Drawing 9] Schematics for explaining the gestalt 9 of operation of this invention which applied this invention to protection of a hybrid converter.

[Drawing 10] Schematics for explaining the protective device of the power converter by the conventional technique.

[Description of Notations]

1 Transformer for Converters

11 Primary Winding

12 Secondary Winding

121 1st Secondary Winding

122 2nd Secondary Winding

2 12 Phase Self-excitation Type Power Converter

2A Power converter

2B Power converter

20A Self-excitation type power converter

20B Self-excitation type power converter

3 12 Phase Hybrid Converter

3A Hybrid converter

3B Hybrid converter

30A Diode rectifier

30B Diode rectifier

4 Hybrid Converter  
5 Diode Rectifier  
6 Self-excitation Formula Translation Machine  
7 Self-excitation Type Power Converter  
17 Feeder (Positive Electrode)  
18 Feeder (Negative Electrode)  
19 Car  
20 Protective Relay (Protection Ry)  
81 Current Detecting Element  
82 Current Detecting Element  
83 Current Detecting Element  
84 Current Detecting Element  
85 Current Detecting Element  
86 Current Detecting Element  
87 Current Detecting Element  
88 Current Detecting Element  
89 Current Detecting Element  
90 Current Detecting Element  
91 Current Detecting Element

## CLAIMS

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[Claim(s)]

[Claim 1]

It is the protective device of the power converter which equips juxtaposition with 2 sets of power converters of the same possible configuration of power running and regeneration operation between common AC power supply and a direct-current load. The 1st current detection means which detects one current of said 2 sets of power converters, When both the current values detected by the 2nd current detection means which detects the total current of 2 sets of said power converters, and said 1st and 2nd current detection means are compared and both current values shift beyond a predetermined value, The protective device of the power converter characterized by having the protective relay judged to be one [ at least ] internal fault of 2 sets of said power converters.

[Claim 2]

It has the transformer for converters which has 2 sets of secondary windings between said AC power supply and said power converters. One side of 2 sets of said secondary windings is connected to one side of 2 sets of power converters. Another side of 2 sets of said secondary windings While outputting the electrical potential difference which has predetermined phase contrast to one [ said ] secondary winding, it connects with another side of 2 sets of said power converters. Said 2 sets of power converters consist of self-excitation formula translation machines, respectively, and said 1st current detection means is formed in one ac side of 2 sets of said power converters. Said 2nd current detection means is the protective device of the power converter according to claim 1 characterized by being prepared in the upstream of said transformer for converters.

[Claim 3]

It has the transformer for converters which has 2 sets of secondary windings between said AC power supply and said power converters. One side of 2 sets of said secondary windings is connected to one side of 2 sets of power converters. Another side of 2 sets of said secondary windings While outputting the electrical potential difference which has predetermined phase contrast to one [ said ] secondary winding, it connects with another side of 2 sets of said power converters. Said 1st current detection means is formed in one ac side of 2 sets of said power converters, and said 2nd current detection means is formed in the upstream of said transformer for converters. Said 2 sets of power converters, respectively The diode rectifier for power running, The protective device of the power converter according to claim 1 characterized by consisting of self-excitation formula translation machines for regeneration operation by which parallel connection was carried out to this.

[Claim 4]

It has the transformer for converters which has 2 sets of secondary windings between said AC power supply and said power converters. One side of 2 sets of said secondary windings is connected to one side of 2 sets of power converters. Another side of 2 sets of said secondary windings While outputting the electrical potential difference which has predetermined phase contrast to one [ said ] secondary winding, it connects with another side of 2 sets of said power converters. Said 1st current detection means is formed in one said 2 sets of direct-currents side of a power converter, and said 2nd current detection means is formed in the upstream of said transformer for converters. Said 2 sets of power converters, respectively The diode rectifier for power running, The protective device of the power converter according to claim 1 characterized by

consisting of self-excitation formula translation machines for regeneration operation by which parallel connection was carried out to this.

[Claim 5]

It is the protective device of the power converter which equips juxtaposition with 2 sets of power converters of the same possible configuration of power running and regeneration operation between common AC power supply and a direct-current load. When the current value detected by 1st and 2nd current detection means to detect each current of 2 sets of said power converters, and both [ these ] the currents detection means is compared and both current values shift beyond a predetermined value, The protective device of the power converter characterized by having the protective relay judged to be one [ at least ] internal fault of 2 sets of said power converters.

[Claim 6]

It is the protective device of the power converter according to claim 5 which said 2 sets of power converters consist of self-excitation formula translation machines, respectively, and is characterized by forming said 1st and 2nd current detection means in the ac side of 2 sets of said power converters, respectively.

[Claim 7]

It is the protective device of the power converter according to claim 5 which said 2 sets of power converters consist of a diode rectifier for power running, and a self-excitation formula translation machine for regeneration operation by which parallel connection was carried out to this, respectively, and is characterized by forming said 1st and 2nd current detection means in the ac side of 2 sets of said power converters, respectively.

[Claim 8]

It is the protective device of the power converter according to claim 5 which said 2 sets of power converters consist of a diode rectifier for power running, and a self-excitation formula translation machine for regeneration operation by which parallel connection was carried out to this, respectively, and is characterized by forming said 1st and 2nd current detection means in said 2 sets of direct-currents side of a power converter, respectively.

[Claim 9]

It is the protective device of the power converter equipped with the hybrid converter which carried out parallel connection of a diode rectifier and the self-excitation formula translation machine between common AC power supply and a direct-current load. The 1st current detection means which detects the alternating current of said hybrid converter, When the current value detected by the 2nd current detection means which detects the direct current of said hybrid converter, and said 1st and 2nd current detection means is compared and both current values shift beyond a predetermined value, The protective device of the power converter characterized by having the protective relay judged to be one [ at least ] internal fault of said diode rectifier and a self-excitation formula translation machine.

[Claim 10]

The 1st current detection means which is the protective device of the power converter equipped with the hybrid converter which carried out parallel connection of a diode rectifier and the self-excitation formula translation machine between common AC power supply and a direct-current load, and detects the direct current of said diode rectifier, The 2nd current detection means which detects the direct current of said hybrid converter, The direct current of said diode rectifier detected by said 1st current detection means becomes beyond a predetermined value. And the protective device of the power converter characterized by having the protective relay which judges it by

detecting that the direct current of said hybrid converter detected by said 2nd current detection means is negative to be the internal fault of said hybrid converter.

[Claim 11]

The 1st current detection means which is the protective device of the power converter equipped with the hybrid converter which carried out parallel connection of a diode rectifier and the self-excitation formula translation machine between common AC power supply and a direct-current load, and detects the direct current of said diode rectifier, The direct current of said diode rectifier detected by the 2nd current detection means which detects the direct current of said self-excitation formula translation machine, and said 1st current detection means becomes beyond a predetermined value. And the protective device of the power converter characterized by having the protective relay which judges it by detecting that the direct current of said self-excitation formula translation machine detected by said 2nd current detection means is negative to be the internal fault of said hybrid converter.

